WINTER FORECAST 2013/2014

FOR SOUTHWEST LOWER MICHIGAN

BY

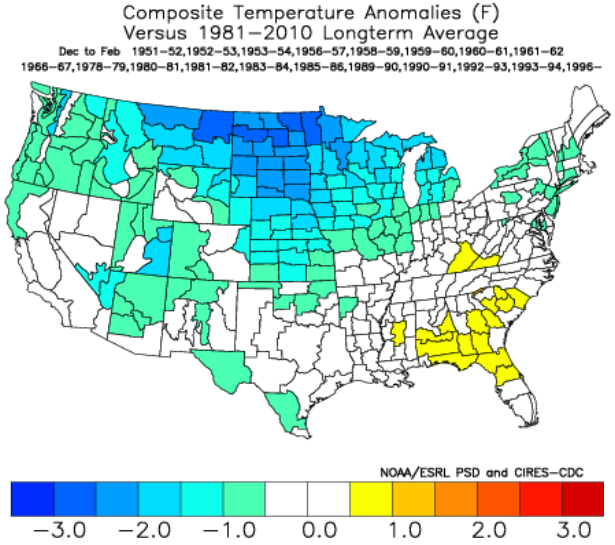
WILLIAM MARINO NWS GRR

Winter forecast 2013/2014

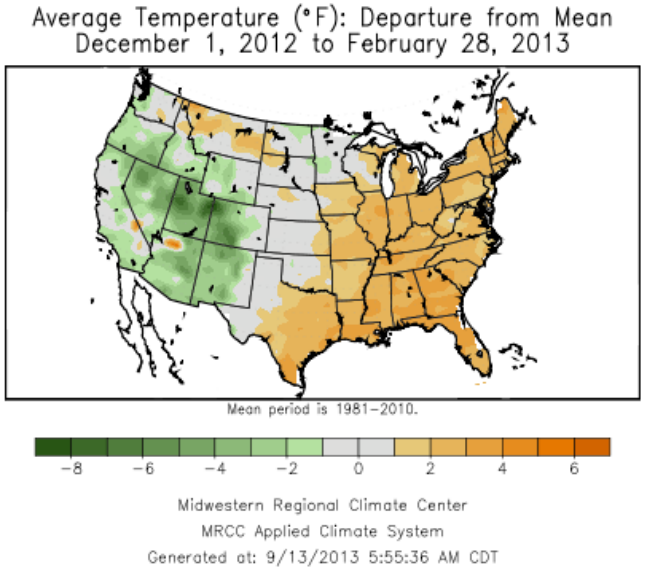
- Review of last winters forecast
  - Temperature verification
  - Precipitation verification
  - Snowfall verification
- The forecast for this coming winter
  - ENSO
  - East Asian Snow Cover
  - Temp forecast
  - Precipitation forecast
  - Snow forecast

Winter 2012-13 Review

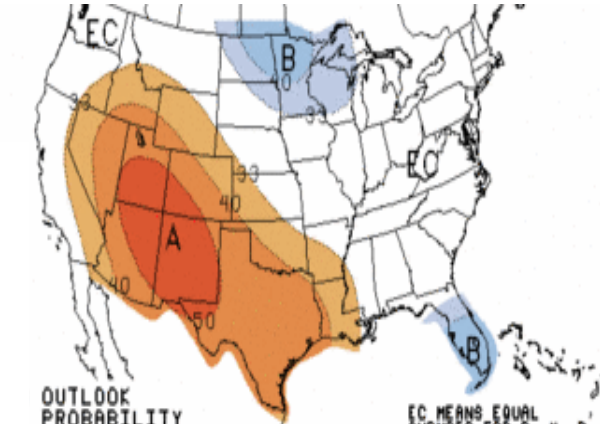
How did our temperature forecast turn out from last year?



NWS GRR Forecast
Temp. Anomaly
For Winter 2012-2013



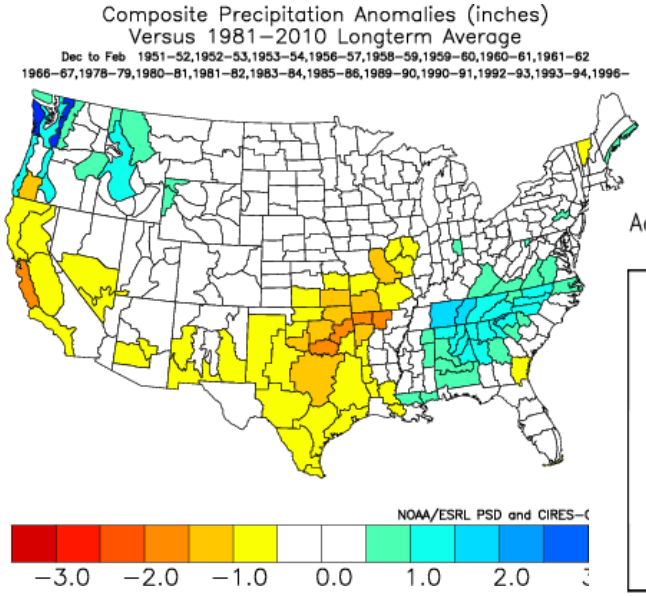
Observed Temp. Anomaly
for Winter 2012-2013



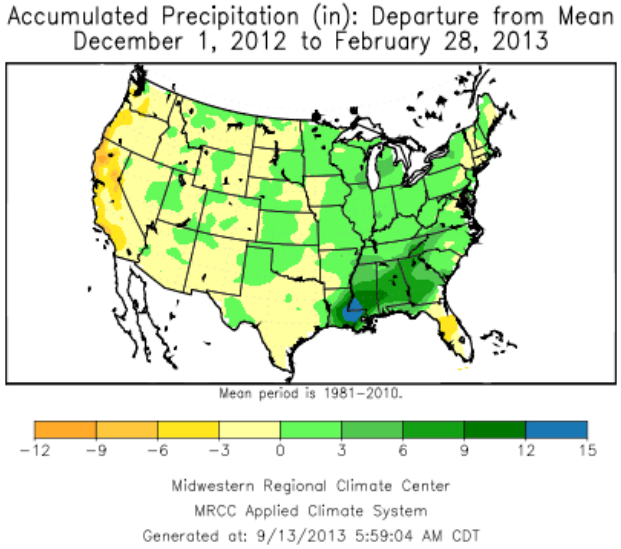
CPC forecast Temp
Anomaly for Winter
2012-2013

Winter 2012-13 Review

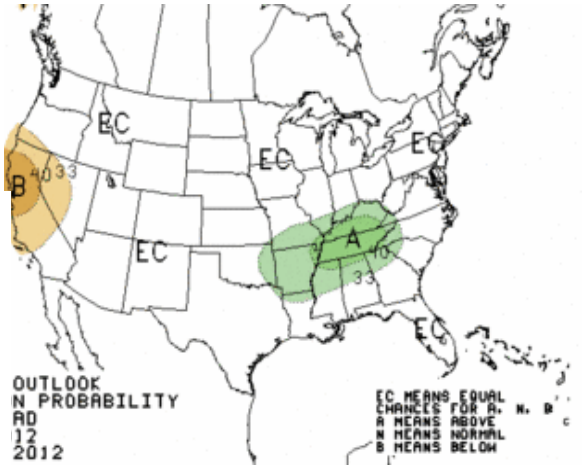
How did our precipitation forecast turn out from last year?



NWS GRR Forecast
Precipitation Anomaly
For Winter 2012-2013



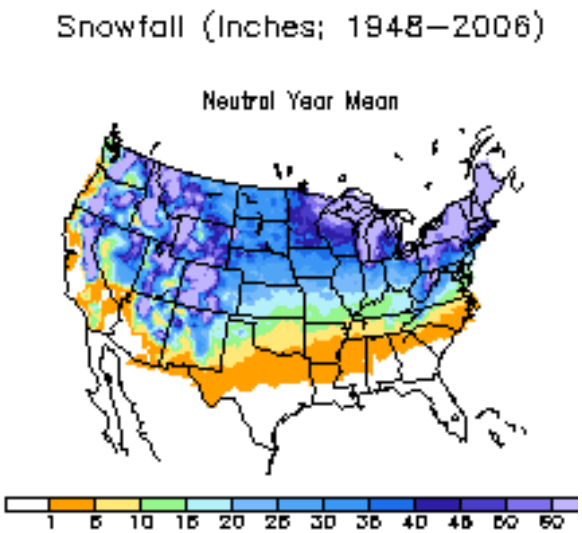
Observed Precipitation Anomaly
for Winter 2012-2013



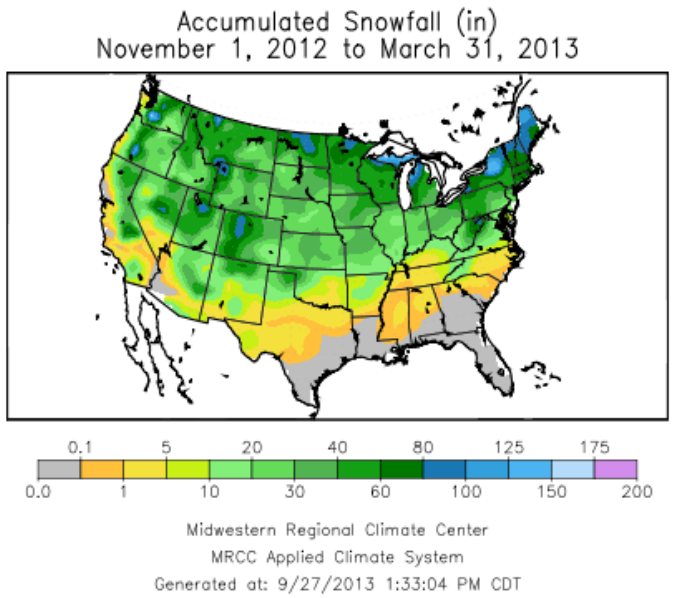
CPC forecast
Precipitation Anomaly for
Winter 2012-2013

Winter 2012-13 Review

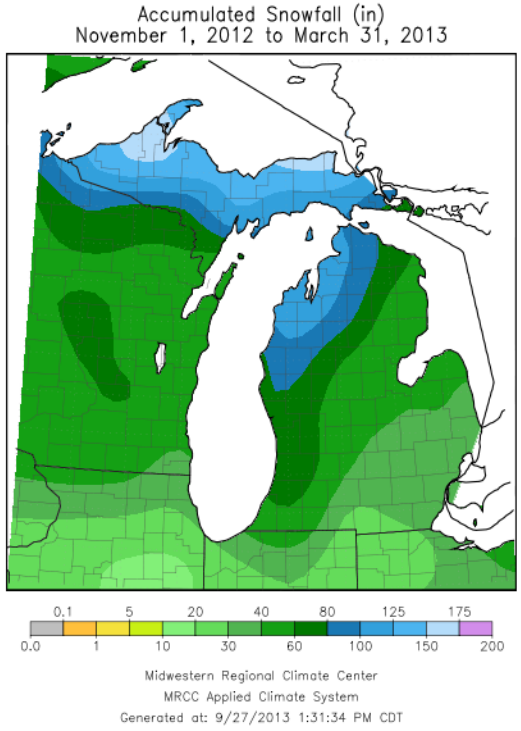
How did our snow forecast turn out from last year?



CPC forecast Snowfall Correlation Anomaly
ENSO
Neutral Winters

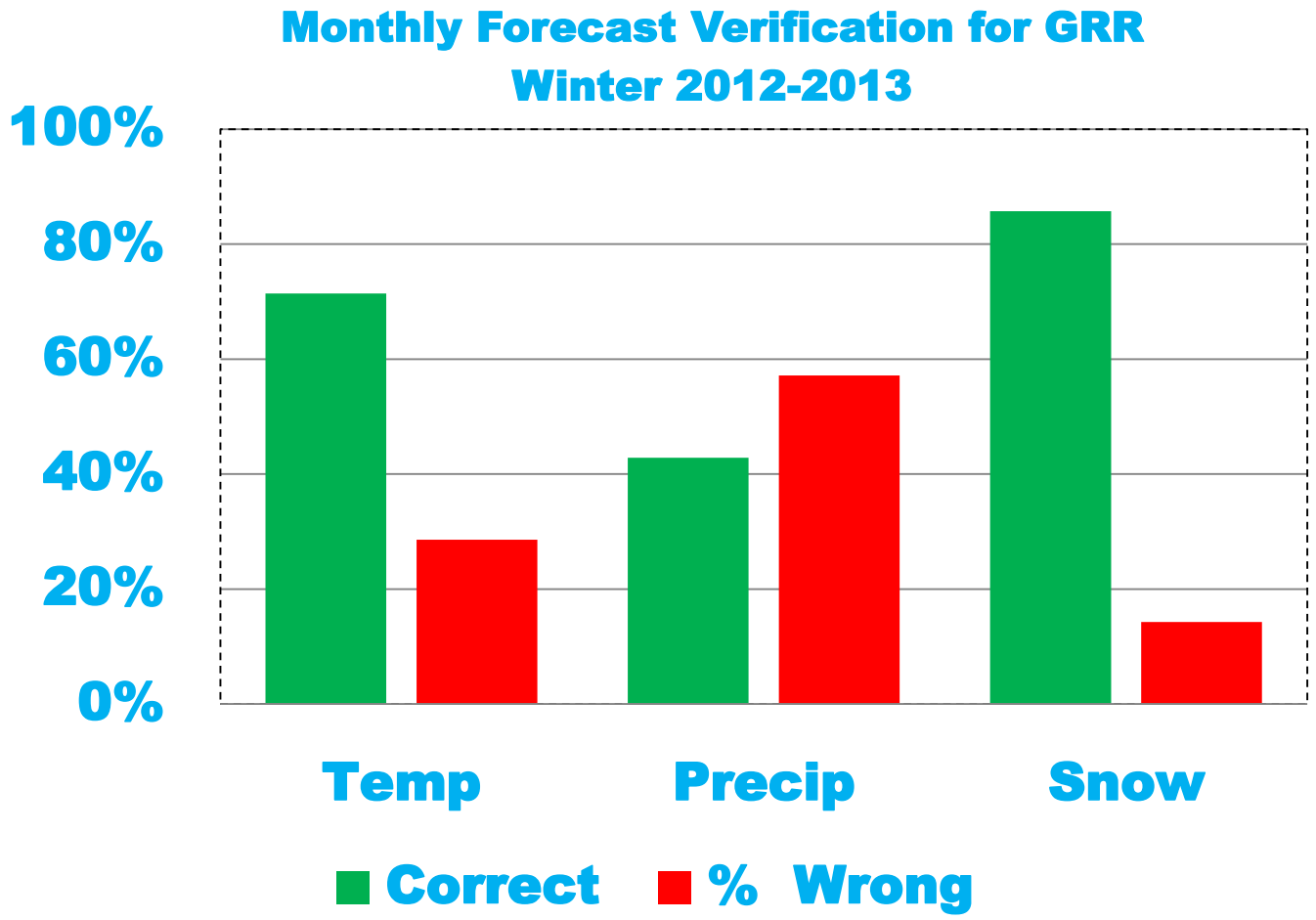


CONUS Snowfall for Winter of 2012-2013



Michigan Snowfall for Winter 2012-2013

Winter 2012-13 Review



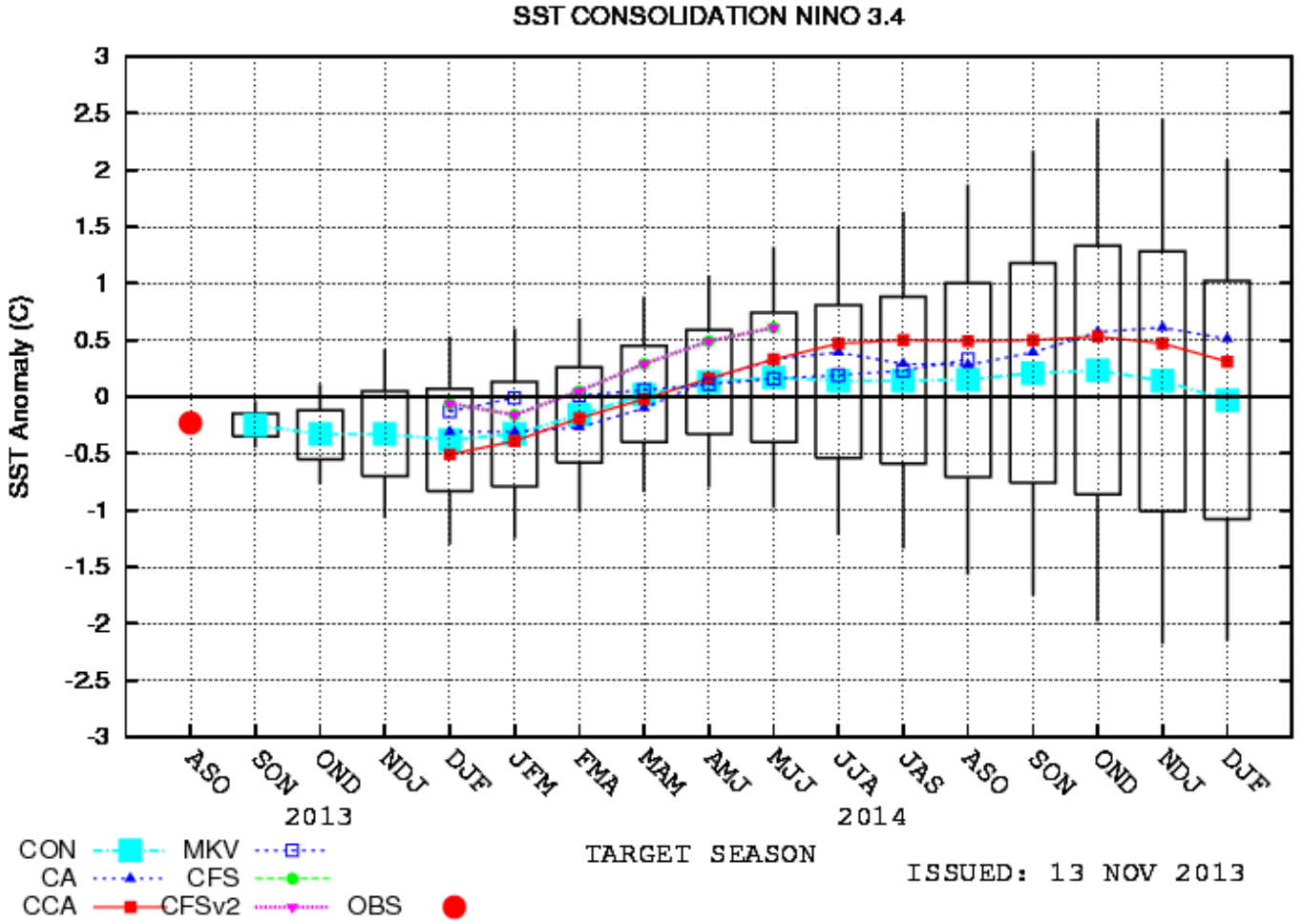
Percent correct monthly forecasts from October 2012 through September 2013 for temperature, precipitation and snowfall (November-April).

Winter Forecast 2013-14

- ENSO
  - ENSO 3.4 region CPC forecast
  - Correlation of Temp. And Precipitation for CONUS
- East Asian /Northern Hemisphere Snow Cover Anomaly Correlation
- Forecast Temperatures
- Forecast Precipitation
- Forecast Snowfall

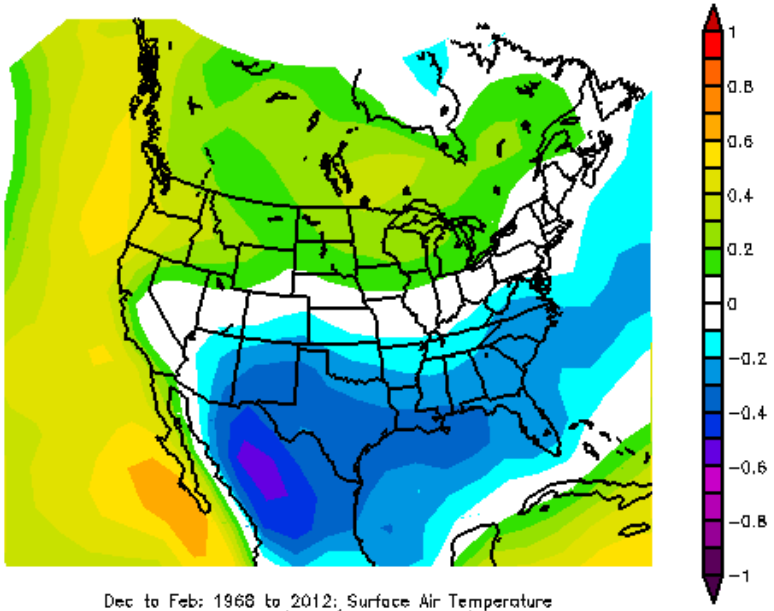
WINTER FORECAST 2013-14

The CPC ENSO forecast for this winter is neutral



Winter Forecast 2013-14

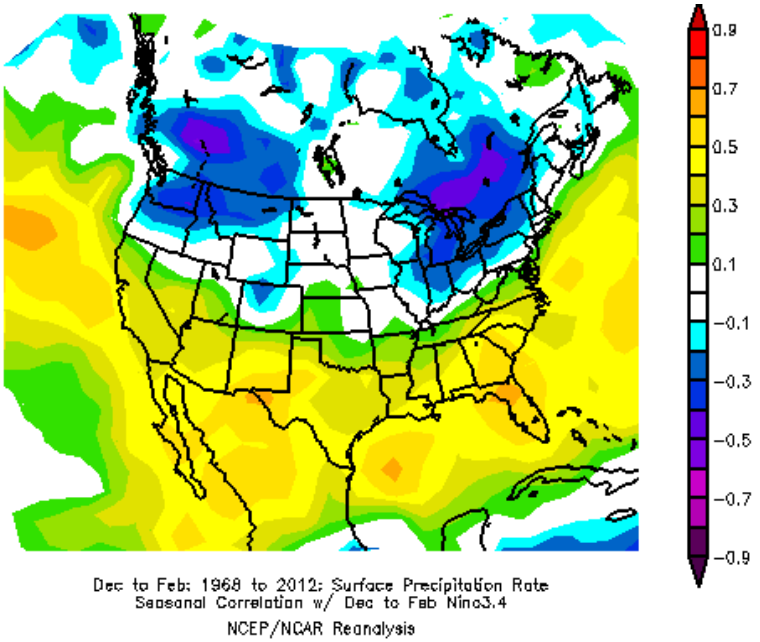
NINO 3.4 Correlation to the Winter Temperature Anomalies over North America



- There is a slight positive correlation over Michigan for the winter mean temperature anomaly to the NINO 3.4 Index.
- Which suggests with ENSO near neutral, Southwest Michigan should see near normal temperatures
- **Note that for an anomaly to be statistically significant the value has to exceed ±0.3**

Winter Forecast 2013-14

NINO 3.4 Correlation to the Winter Precipitation Anomalies over North America



- There is a slight negative correlation over Michigan for the winter precipitation anomaly to the NINO 3.4 Index.
- Which suggests with ENSO near neutral, Southwest Michigan should see near normal precipitation.
- **Note that for an anomaly to be statistically significant the value has to exceed ±0.3**

Winter Forecast 2013-14

East Asian Snow Cover Correlation

- The Autumn Tibetan Plateau Snow Cover to Seasonal Prediction of North American Winter Temperature is significant, more so than ENSO for Southwest Michigan.

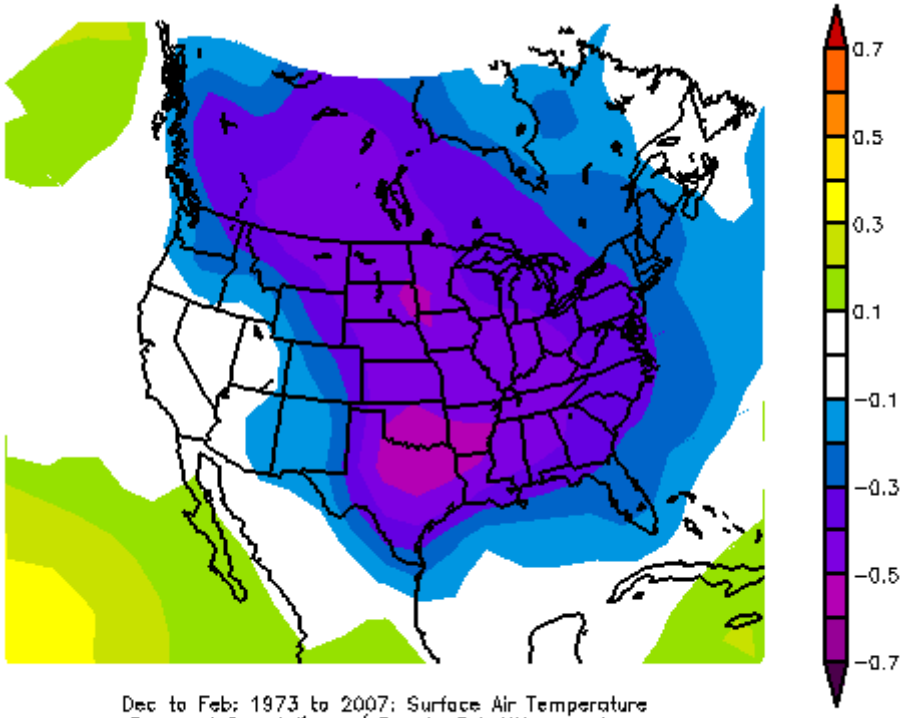
- A positive TP snow cover anomaly may induce a negative sea level pressure and geopotential height anomaly over the eastern North Pacific, a positive geopotential height anomaly over Canada, and a negative anomaly over the southeastern United States. This is a structure very similar to the positive phase of the Pacific–North America (PNA) pattern.

- This pattern usually favors the occurrence of a warm–north, cold–south winter over the NA continent.

- When a negative snow cover anomaly occurs, the situation tends to be opposite.

WINTER FORECAST 2013-14

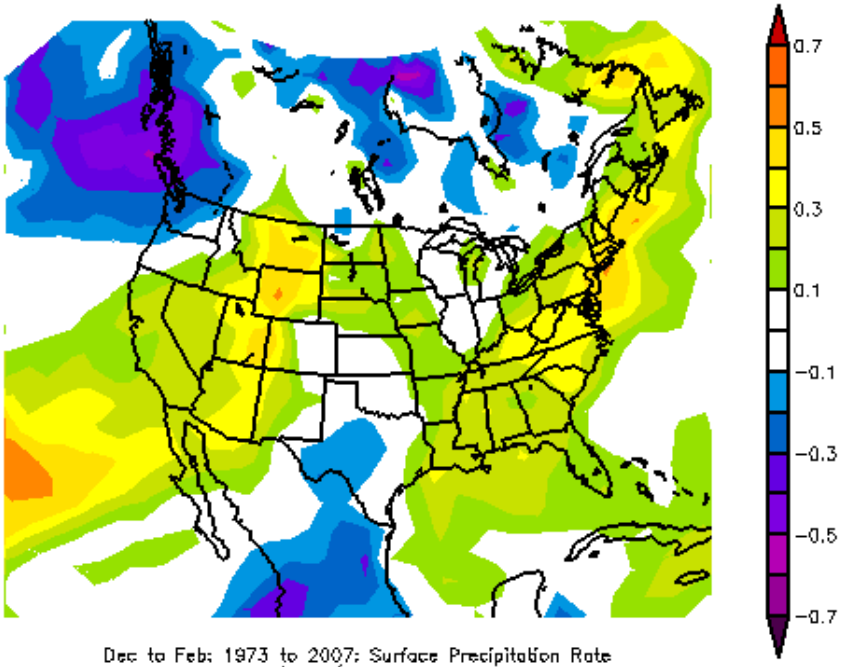
The Northern Hemisphere Snow Cover Anomaly Makes a difference to winter temperature anomalies for the CONUS.



- The Correlation of the Northern Hemisphere snow cover anomaly to the CONUS winter temperatures is strong and negative. This suggests a positive snow cover anomaly would mean a colder than normal winter, and visa-versa
- **Note that for an anomaly to be statistically significant the value has to exceed ±0.3**

WINTER FORECAST 2013-14

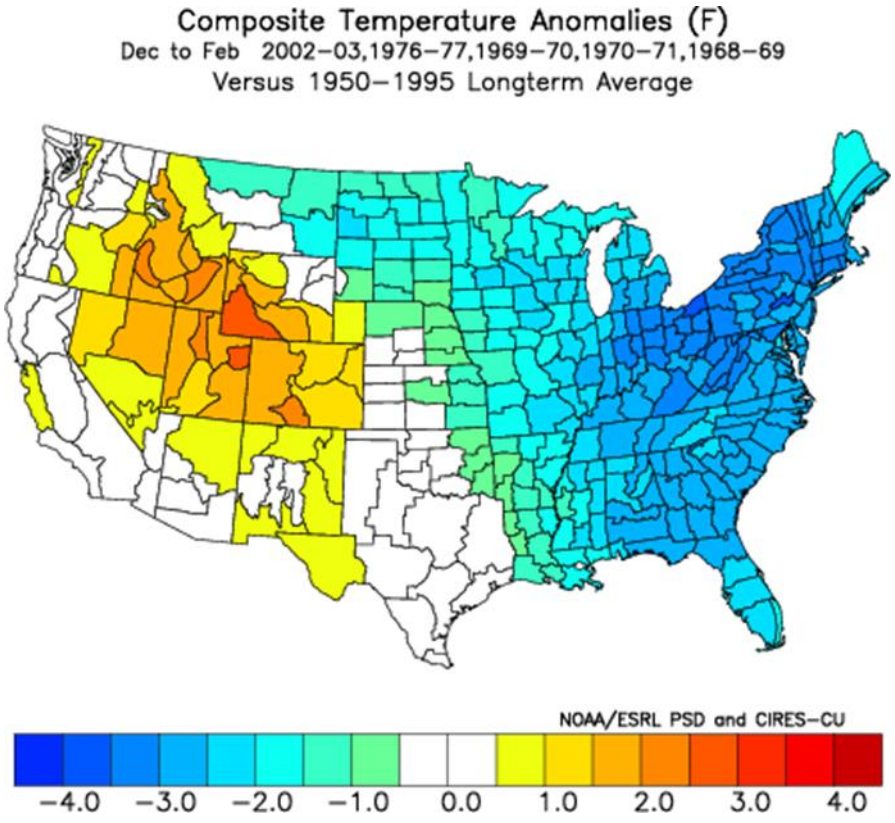
The Northern Hemisphere Snow Cover Anomaly Makes
little difference to winter precipitation anomalies for the CONUS.

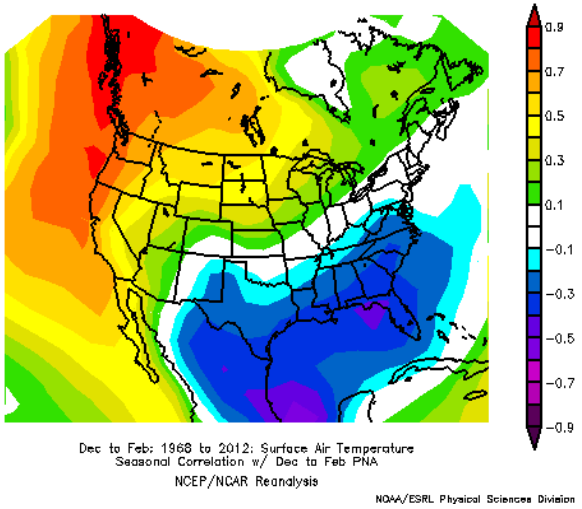


- The Correlation of the Northern Hemisphere snow cover anomaly to the CONUS winter precipitation is near zero (no significant signal).
- **Note that for an anomaly to be statistically significant the value has to exceed ±0.3**

Winter Forecast 2013-14

When the East Asian Snow Cover (EASC) Anomaly for October is more than 2.1 million sq. km above normal (1 standard deviation) the resulting winter temperature pattern looks like a positive PNA pattern for CONUS.



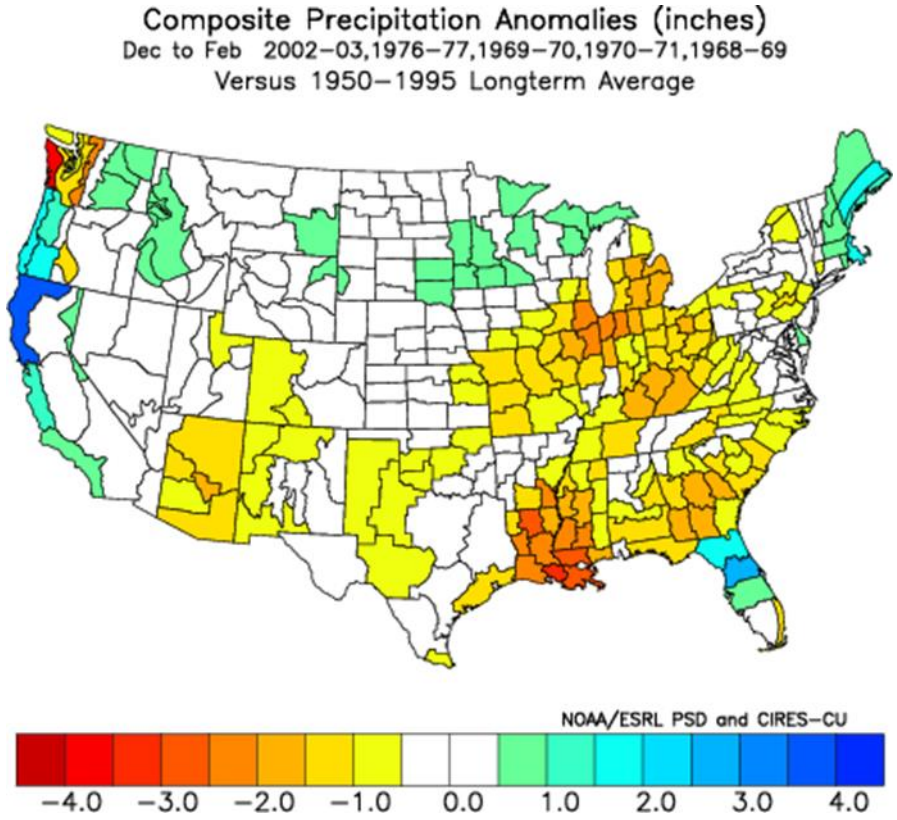


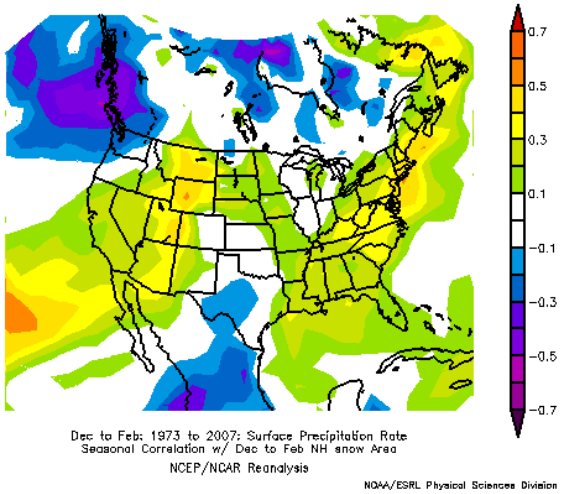
Temperature Correlation for a Positive PNA

Temperature anomaly for above normal East Asian snow cover puts Southwest Michigan around 3.0 degrees below normal.

Winter Forecast 2013-14

When The East Asian Snow Cover in October Anomaly is more than 2.1 million sq. km above normal (1 standard deviation) the resulting winter precipitation pattern looks like a positive PNA pattern for CONUS.



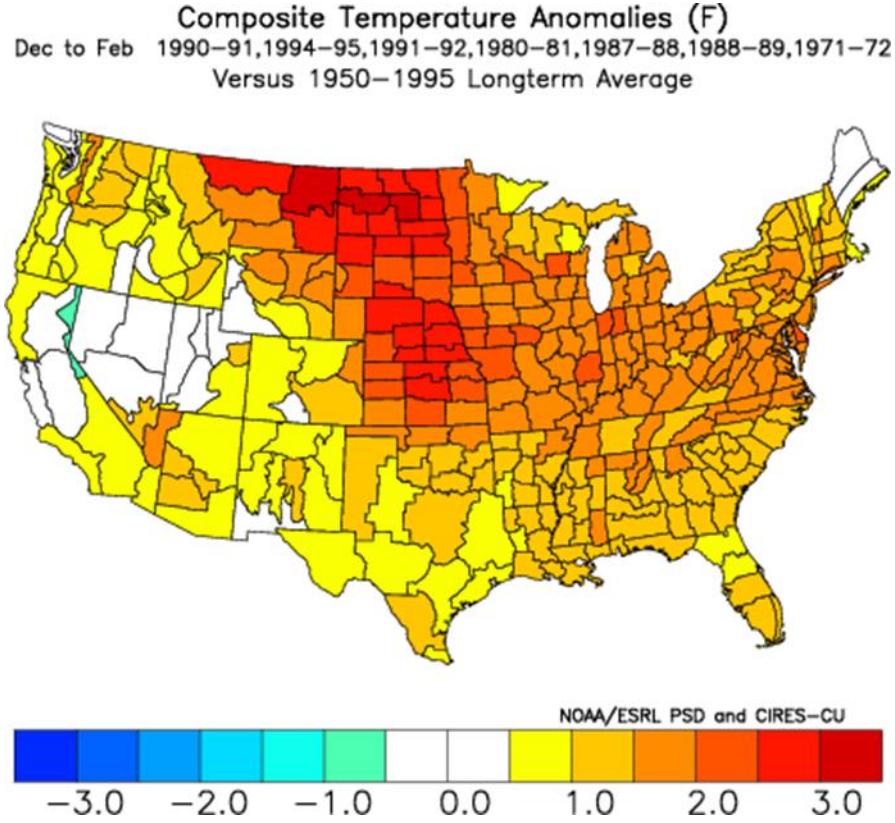


Precipitation Correlation for a Positive PNA

Precipitation Anomaly for a positive East Asian Snow Cover results in precipitation totals averaging around 2” below normal over Southwest Michigan (weak correlation)

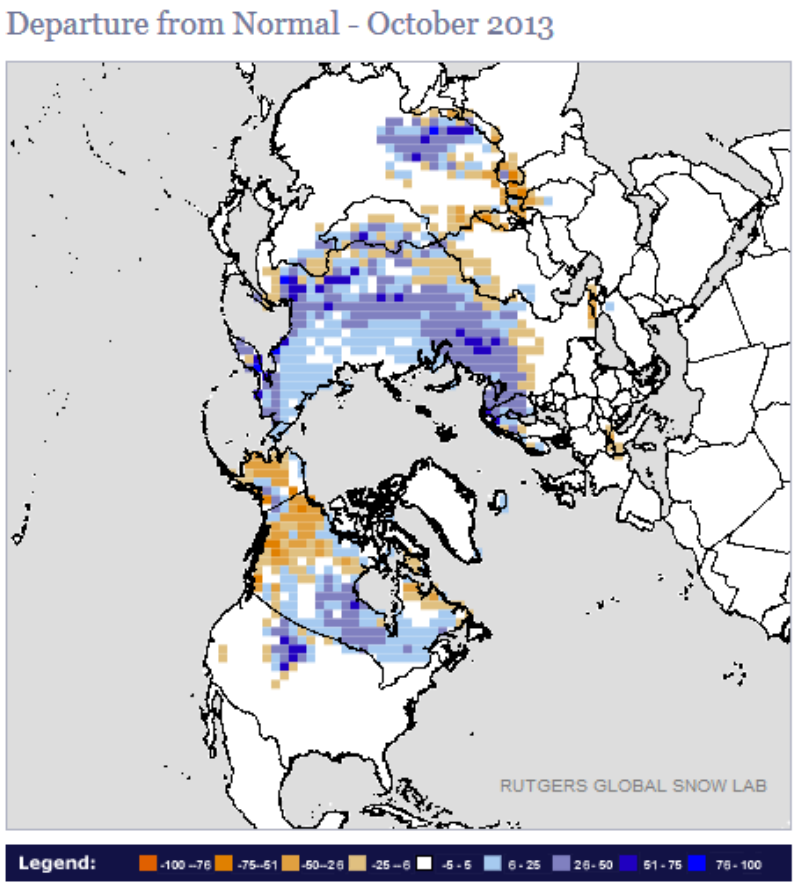
Winter Forecast 2013-14

When The East Asian Snow Cover anomaly in October is more than 2.1 million sq. km below normal (1 standard deviation) the resulting winter temperature pattern looks like a negative PNA pattern for CONUS.



Temperature anomaly for below normal East Asian snow cover puts Southwest Michigan around 1.5 degrees above normal.

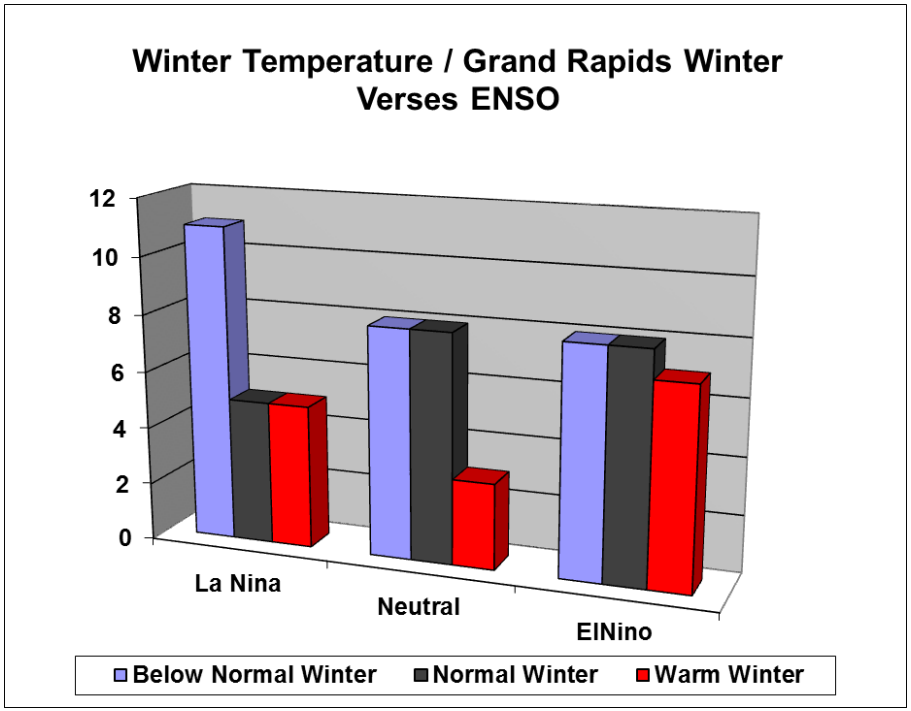
OCTOBER 2013 SNOW COVER DEPARTURE FROM NORMAL



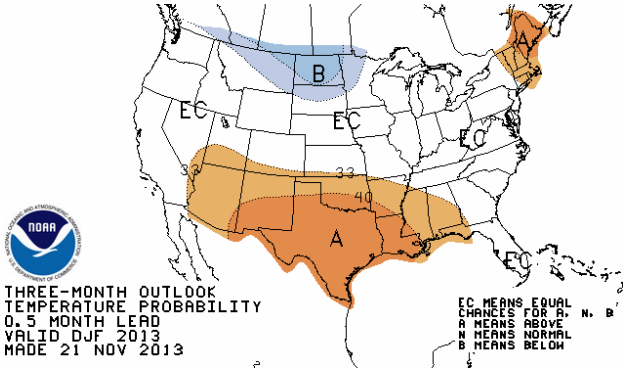
The EASCA for October 2013 was 2.88 million sq. km above normal, that is the 3rd highest on record (since 1968) .

Winter Forecast 2013-14

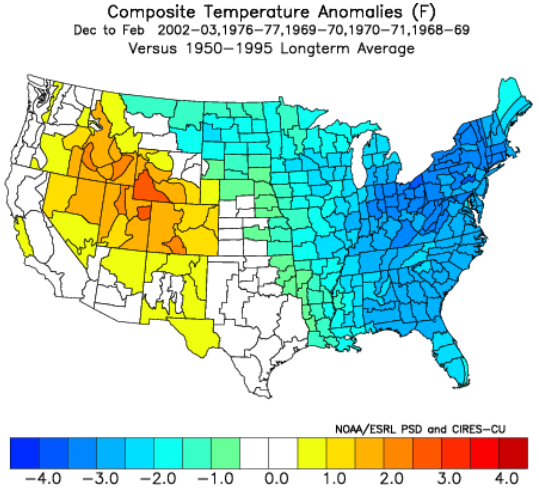
Temperature



ENSO temperature anomaly frequencies for Grand Rapids

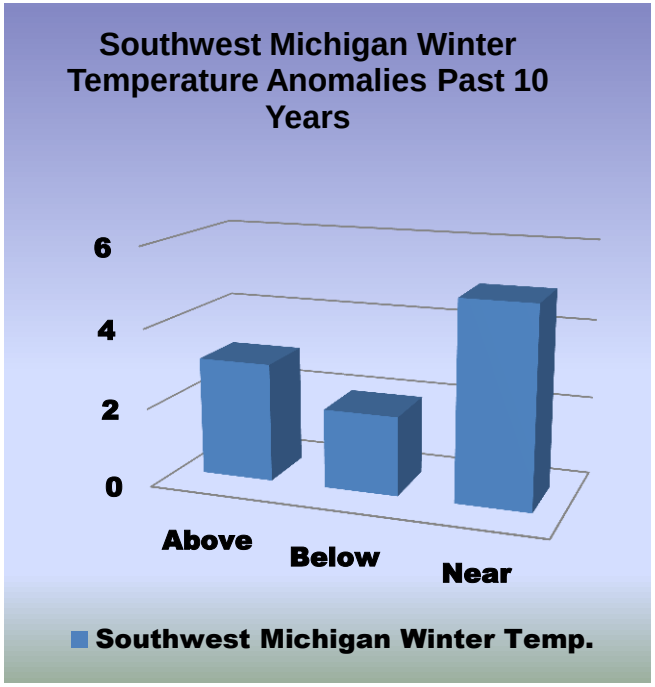


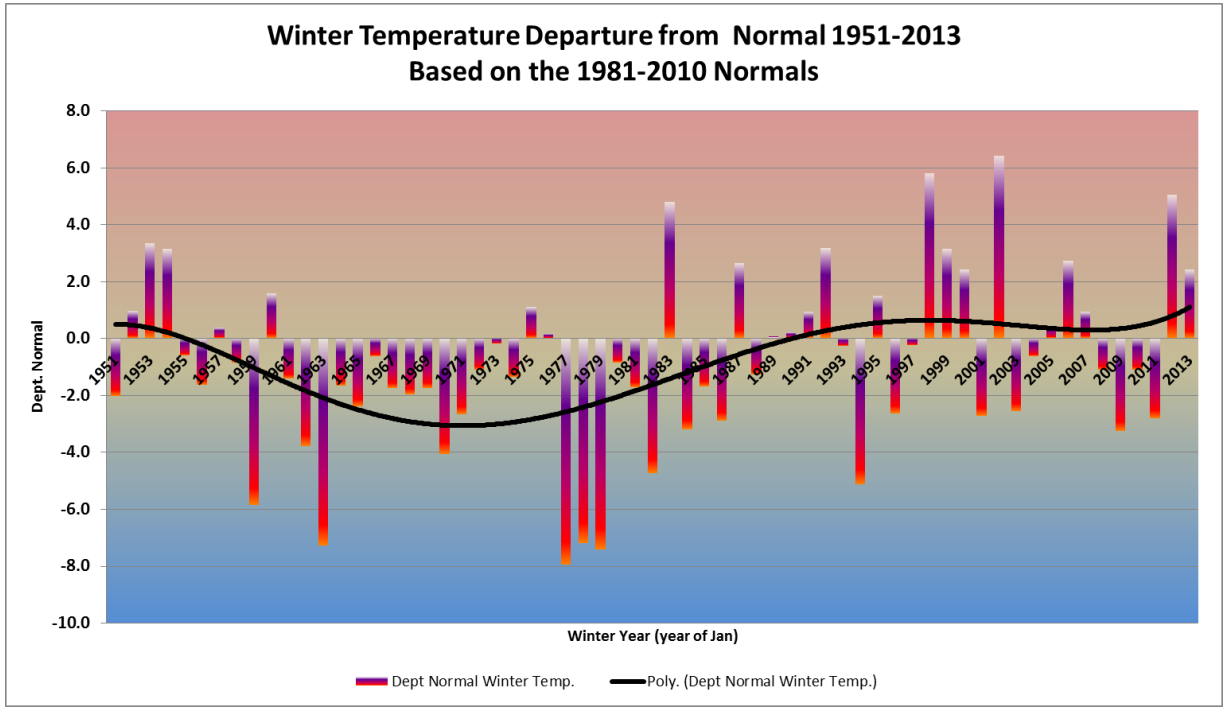
CPC Temperature Forecast for the winter of 2013-2014



EASCA temperature forecast for the winter of 2013-2014

Winter Forecast 2013-14





Southwest Michigan frequency of the winter temperature anomalies for the past 10 years

Yearly winter temperature anomalies for Southwest Michigan since the winter of 1950/1951

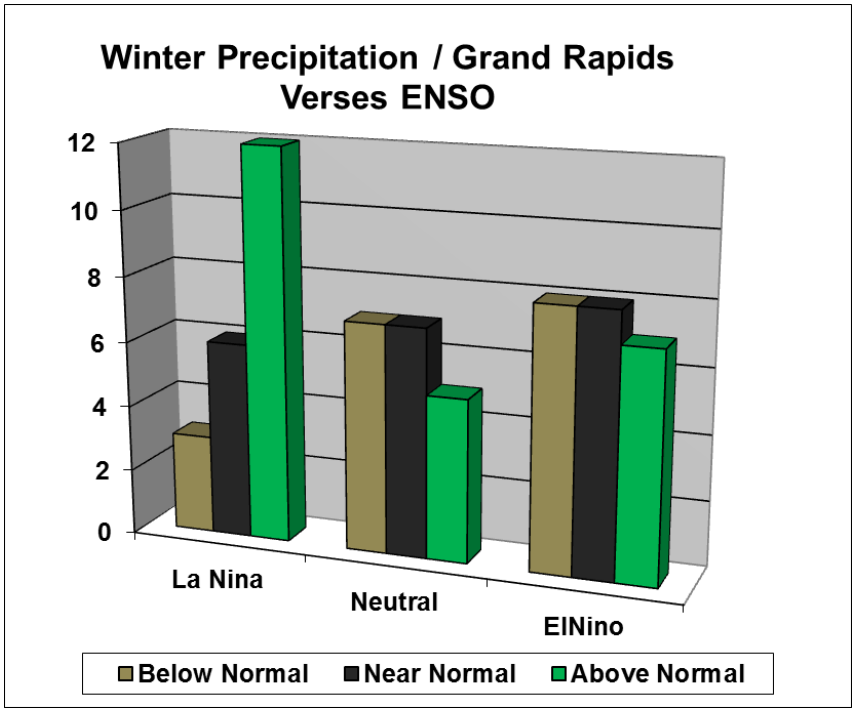
Note the lack of trend in the winter temperatures for Southwest Michigan since the winter of 2000/2001

Winter Forecast 2013-14 Temperature Forecast

1. With ENSO being neutral this winter, the warmer than normal is the least likely outcome.
2. The snow cover anomaly for October 2013 is the 3rd highest on record (1968-2012)
3. The CPC forecast suggests there is not enough information to make a forecast
4. **As a result our forecast suggests the most likely outcome for the winter of 2013/2014 temperature to be near to below normal**.

Winter Forecast 2013-14

Precipitation



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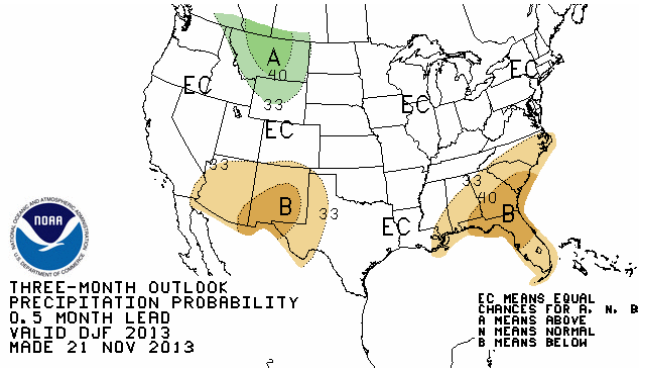
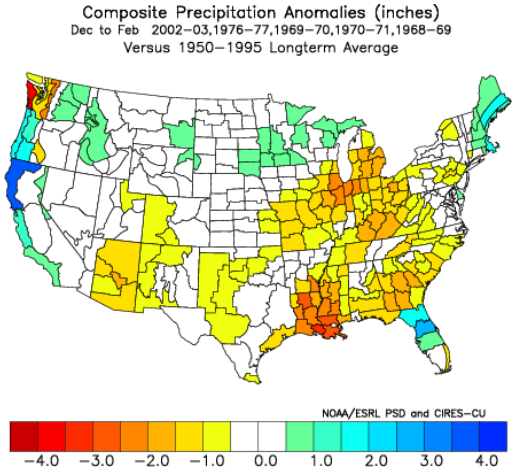
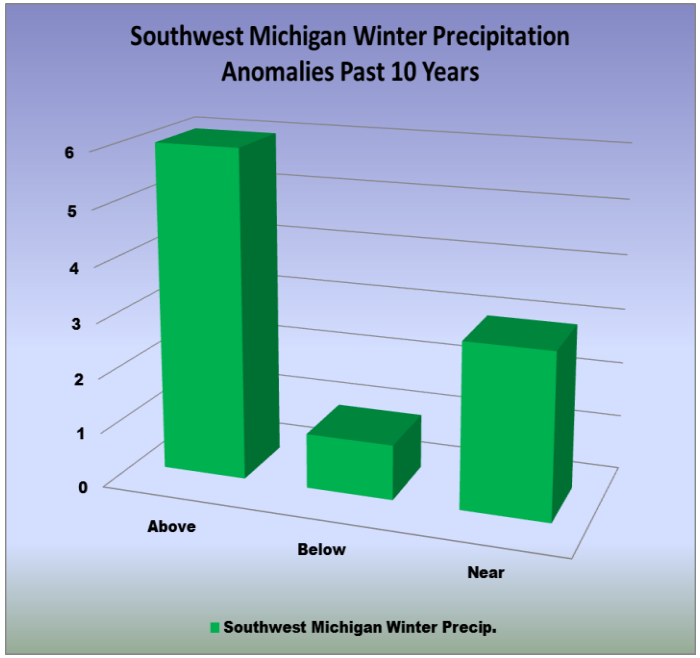


The CPC precipitation anomaly forecast for the winter of 2013-2014

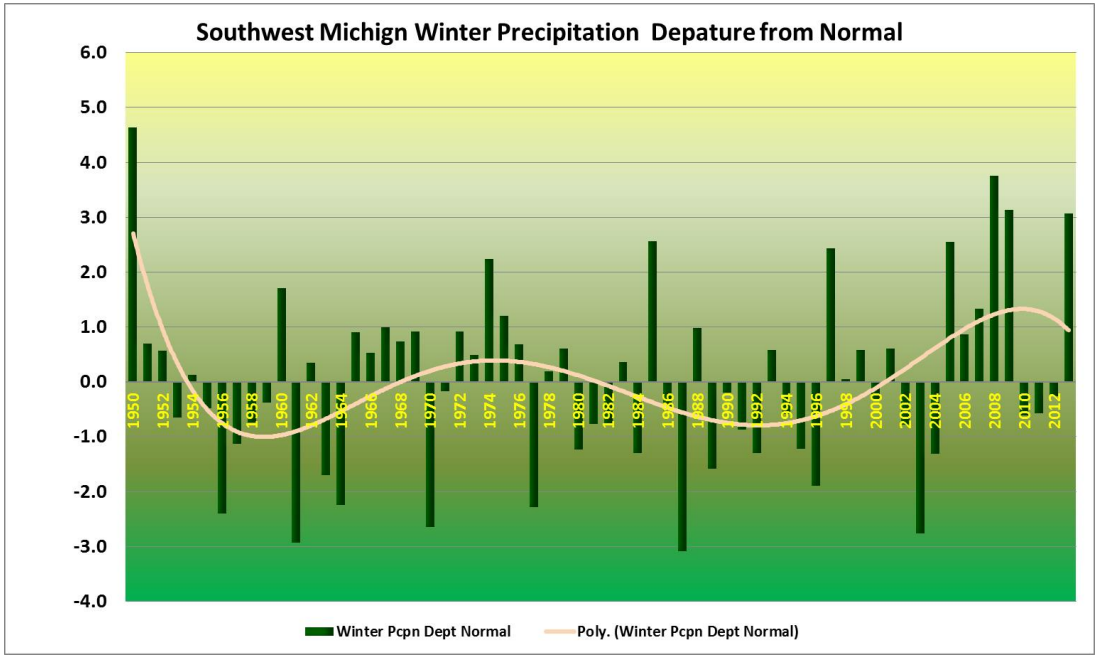


EASCA precipitation forecast for the winter of 2013-2014

Winter Forecast 2013-14



The frequency of above, near and below normal precipitation for the past 10 for Southwest Lower Michigan



The yearly precipitation anomaly from 1949/1950 through 2012/2013

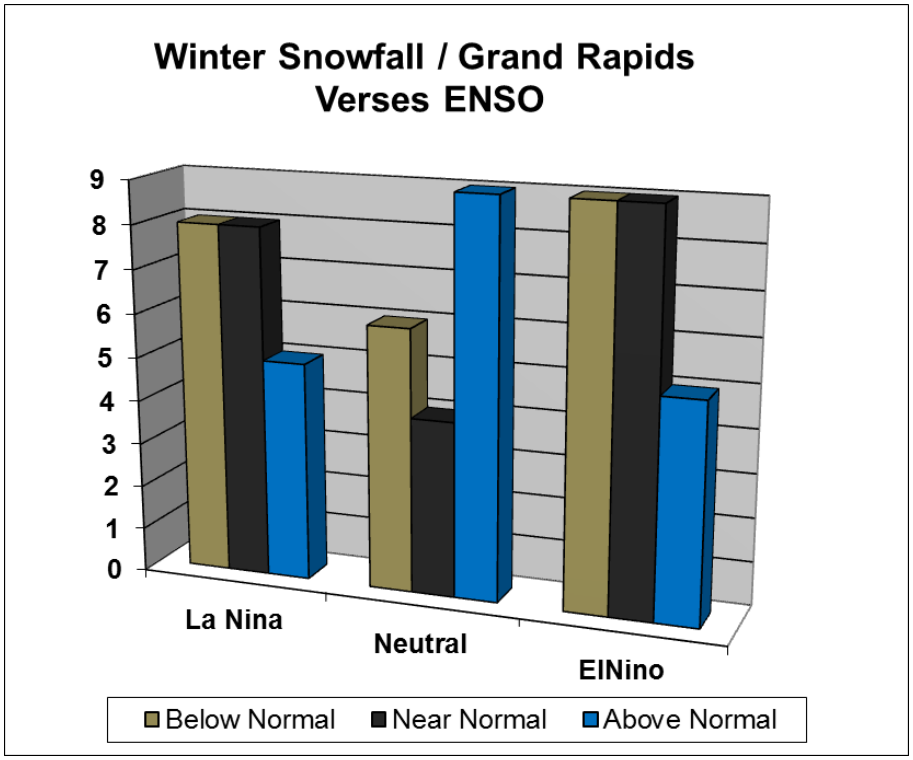
The trend in winter precipitation over the past 10 years strongly favors wet winters with 6 of the last 10 wetter than normal across Southwest Lower Michigan

Winter Forecast 2013-14 Precipitation Forecast

1. With ENSO being neutral this winter, no significant trend it noted.
2. The snow cover anomaly shows no skill to forecast a precipitation trend
3. The CPC forecast suggests there is not enough information to make a forecast
4. **As a result there is not enough information to make a skillful forecast for the precipitation anomaly.**

Winter Forecast 2013-14

Snowfall



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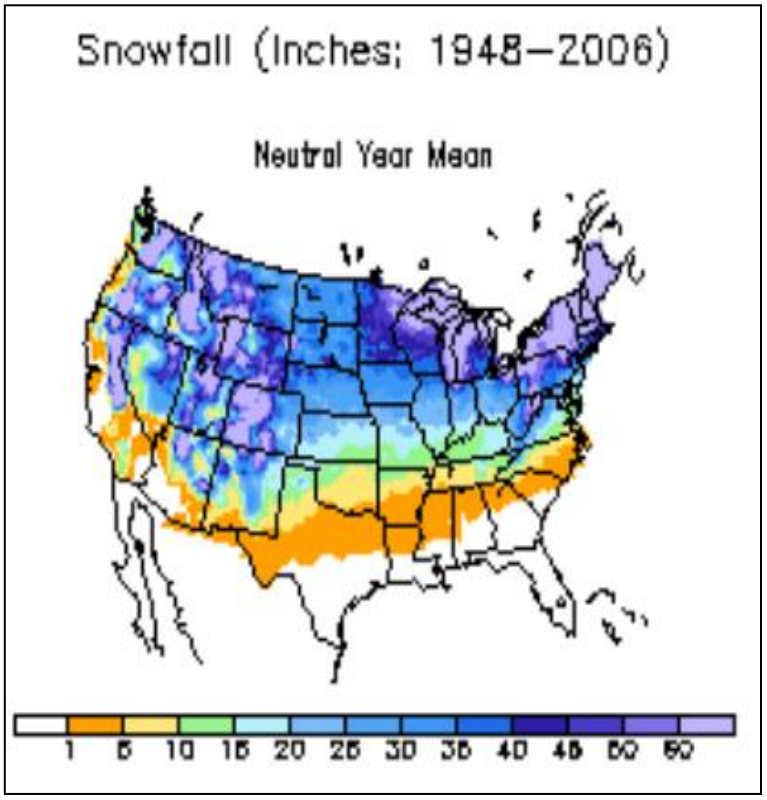

CPC forecast Snowfall Correlation for ENSO Neutral Winters

WINTER FORECAST 2013-14

TEMPERATURE: NEAR TO BELOW NORMAL

PRECIPITATION: NEAR TO BELOW NORMAL

SNOWFALL: NEAR NORMAL INLAND

ABOVE NORMAL BY THE LAKE SHORE

References

- Lin, Hai, Zhiwei Wu, 2011: Contribution of the Autumn Tibetan Plateau Snow Cover to Seasonal Prediction of North American Winter Temperature. J. Climate, 24, 2801–2813. doi: http://dx.doi.org/10.1175/2010JCLI3889.1
- CPC Winter Forecast
- Rutgers Snow Lab
- The Midwest Climate Center
- PDS Interactive Plotting Pages Earth System Research Laboratory